

(On the Waterfront cont'd.)

of PVC fittings removed from installations and tested, it appears that the ... observations may not hold true for fittings. At least the number of cycles to failure may be considerably less, due to stress concentrations at points of direction change in the fittings."

#### NEXT MONTH: BURST FAILURE AND LONG TERM PRESSURE FAILURE

This month's article is pretty vague. Next month's will be more understandable. I'll bet most of you didn't think I could write something this exciting. Hope this doesn't take as long to type as "War and Peace".

## Management of Fungicide Resistance

by Patricia L. Sanders  
Plant Pathology Department  
Penn State University

Fungicides can be divided into two groups according to where they act to protect plants. CONTACT or PROTECTANT FUNGICIDES are those that stay on plant surfaces and provide a barrier against the fungi that cause disease. ERADICANT or SYSTEMIC FUNGICIDES are absorbed by plants, and thus can work to protect plants from within, in the same way that antibiotics act to eradicate "germs" inside human bodies. Most systemic fungicides also have protectant properties in that they can provide barriers to fungi on plant surfaces. Systemics have the advantage of long residual action, protection of plant crowns and roots, movement within plants to protect newly-formed tissues, eradication of fungi already inside plants, and protection from washoff and weathering.

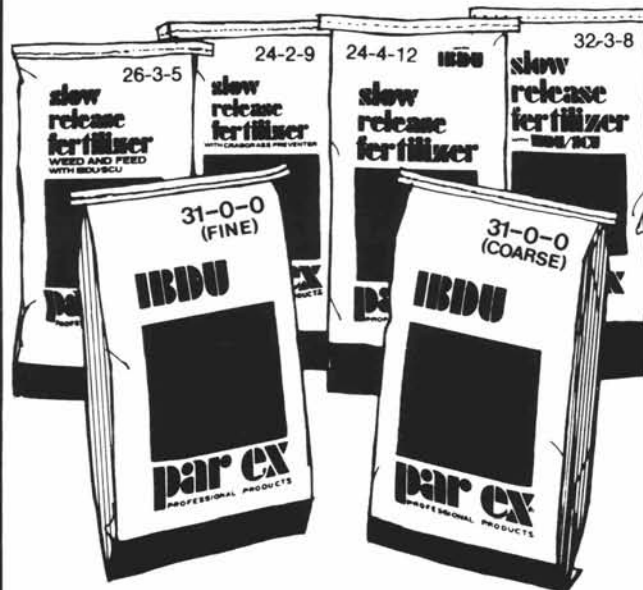
The chief disadvantage of systemic fungicides has been the problem of resistance to these fungicides in many important turf pathogens. Resistance in fungi to systemic fungicides occurs because these fungicides generally poison fungi at only a single location in their growth and development cycles. It is, therefore, relatively likely that some individuals will be present in populations of disease-causing fungi that are able to circumvent or short-circuit the poisoned site. These individuals will be able to grow and increase in the presence of the fungicide. With repeated, continuous application of the same systemic fungicide, the naturally-resistant individuals in a fungal population will multiply until the population is composed primarily of fungicide-resistant individuals, and disease control fails. This has happened in countries all over the world where systemic fungicides have been used. In the U.S.A., most of the disease control failures from resistance to systemic fungicides have occurred on turfgrass. There are published reports of resistance control failures of Tersen 1991 on dollar spot, Subdue on Pythium blight, and Chipso 26019 on dollar spot and pink snow mold.

Identification and development of new fungicides is costly and time-consuming. Therefore, we must learn to use systemics in ways that will prolong their useful lives. In order to prevent or delay fungicide resistance in populations of disease-causing

(cont'd. page 22)

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(Fungicide Resistance cont'd.)

fungi, it has been suggested that systemic fungicides should be alternated or used in mixtures. However, there are very few published research studies on which recommendations for preventing or delaying fungicide resistance can be based. Alterations will be effective in cases where the resistant individuals in the population are not as competitive as sensitive individuals. Thus, the population will fluctuate; the resistant component increasing when the resistance-prone fungicide is applied, and the more vigorous sensitive component increasing when the fungicide selection pressure is not present and the alternate fungicide is being used. Unfortunately, many times the resistant individuals in fungal populations are just as competitive and vigorous as the sensitive ones. In such cases, an alternating program will result in a steady increase in proportion of resistant members, until finally the population is predominantly resistant — a condition we are trying to avoid. In populations of equally-fit resistant and sensitive components, mixtures have been found to be effective in keeping resistant proportions stable in experimental populations.

Assuming that fungicide mixtures are able to keep resistance levels stable in fungus populations, they must be effective in controlling disease. Obviously, we cannot use full rates of fungicides in mixtures, because to do that would increase financial and environmental costs. We need to be sure that reduced rates of fungicides in mixtures will give satisfactory field control of diseases. Field and greenhouse studies have shown that reduced-rate mixtures can give disease control equal to, and sometimes greater than, the additive control of the individual mixture partners alone at the reduced rate. Although much more research is needed, it appears that reduced-rate mixtures can give acceptable field disease control, as well as delaying problems with resistance.

There are several important things to consider when selecting fungicides for use in alternations or reduced-rate mixtures. First, only fungicides with different ways of controlling the target fungus can be used in alternations or mixtures to delay or prevent control failures resulting from fungicide resistance in fungal populations.

The three systemic fungicides registered for Pythium blight control (Banol, Aliette, and Subdue) have different modes of action, and therefore, can be used in alternations or two-component, half-rate mixtures for resistance management and disease control. Three-component, third-rate mixtures of Banol/Aliette/Subdue may also be effective for these purposes, but research to test this is not completed.

The broad-spectrum systemic fungicides that control other turf diseases fall into three groups according to their mode of action: the benzimidazoles (Tersan 1991, Fungo 50, CL 3336), the dicarboximides (Chipco 26019, Vorlan), and the sterol inhibitors (Banner, Bayleton, Rubigan). Any fungus that is resistant to one of the benzimidazole fungicides will be resistant to them all. The same is true within the dicarboximide and sterol-inhibitor groups of fungicides. Therefore, for resistance management, broad-spectrum systemic fungicides must be mixed or alternated BETWEEN but not WITHIN groups. Systemic fungicides may also be mixed or alternated with any contact fungicide that will give the disease control desired.

(cont'd. page 23)

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In addition to mode of action differences, the length of disease control provided by mixture components must be matched to avoid resistance selection. If a short-residual fungicide is included in a mixture for delaying resistance, an interspray of the short-residual chemical probably will be necessary.

If they are available, it is probably much better to use systemic fungicides in mixtures for resistance management. The reason is that the turfgrass plant itself can "unmix" mixtures of contact and systemic fungicides. If you apply a contact/systemic mixture, the mixture will be present on plant surfaces, but the systemic fungicide will be present alone inside the plant. As an example, in the case of a Subdue/Fore mixture, Subdue alone will be acting against **Pythium** that already has invaded the plant. For this reason mixtures of systemics are safer for resistance delay than contact/systemic mixtures.

The management of fungicide resistance in populations of disease-causing fungi is an area where much more research is needed. Additive, synergistic, or antagonistic effects may be possible with particular fungicide mixtures. It is, therefore, important that alternations and mixtures of various fungicides be tested, both for disease control and for resistance delay, in as many use settings and turfgrass/pathogen systems as possible.

Although there is much more we need to know about how we can best use systemic fungicides to avoid disease control failures from fungicide resistance in fungal populations, one thing is clear. We cannot safely use any systemic fungicide repeatedly and exclusively for disease control. Sensible and prudent use of systemic fungicides dictates diversity in chemicals used. Turf managers should be very skeptical of recommendations suggesting that any systemic fungicide can be used alone and continually without risk of resistance problems.

**Editor's Note:** Brian Bossert sent me this article as a follow-up on work Peter Hahn was doing at Ridgemoor C.C.

## "The Good News Is ..."

by Vicki Lynn Sims, C.P.A.

### THE GOOD NEWS IS ...

There are many income items which we receive tax-free. These qualify, because of their natures, under the Internal Revenue Code as "income exclusions".

#### JOB RELATED EXCLUSIONS

These payments benefit the employee, truly serve as compensation, provide a tax deduction for the employer, and are not taxed to the employee. In the case of the non-profit employer (as are many golf clubs), there is no need for the tax deductibility, but any exclusion available to the employee is still important.

#### MEDICAL COVERAGE

The most common area of income exclusion, this coverage represents TWO nontaxable benefits. We do not pay tax on the value of the premium paid on our behalf, and we do not pay tax on the value of the care provided.

#### DEPENDENT CARE ASSISTANCE

This is one of the best, but least used, employee benefits available. The employee may exclude amounts paid by the employer for furnishing dependent care on behalf of the

employee. The employer directly pays the day care, nursing care, etc., the employer deducts the payment as an employee benefit and the employee is not taxed on the payments. The payments are excludable, up to the amount of earned income (for a married employee, the earned income of the lower earning spouse), subject to a \$5000 a year limit (\$2500 for married filing separately). Special rules apply to the situation in which one spouse is a student or is incapacitated.

#### MEALS & LODGING

The value of meals or lodging and utilities furnished to an employee and the employee's family for the convenience of the employer generally is not taxable. The exclusion does not apply if the employee can take cash instead. The exclusion related to housing applies only if the employee must accept the lodging on the employer's premises as a condition of employment.

#### GROUP LEGAL SERVICES

Amounts contributed by an employer to a group legal services plan may be excluded from income by employees, within limits. This exclusion was scheduled to expire after 1988, but has been extended until September 1990 by this Fall's tax act, the Omnibus Budget Reconciliation Act of 1988 (OBRA).

#### EDUCATIONAL ASSISTANCE

Employees may exclude the first \$5,250 in educational benefits provided under an educational assistance program of the employer. This exclusion was also set to expire after 1988, but has been extended by OBRA until September 1990.

#### FRINGE BENEFITS

• **No additional cost services** (course play privileges, flights for airline personnel) provided by an employer to an employee for free, or at a reduced price, are excludable from the employee's income provided:

- (1) the services are for sale to customers in the ordinary course of business, and
- (2) the employer incurs no substantial additional cost in providing such services.

• **Qualified employee discounts** may be excluded if the property or services are ordinarily offered for sale to customers. There are no exclusions for discounts on personal investment or real property.

• **Working condition fringes** include travel advances, the use of a company car, employer provided vehicles and employer provided parking.

• **Travel advances** are excluded if the employee uses the advance for specific activities that are deductible, proves that payment was made, and returns any excess to the employer.

• **Use of a company car** for business purposes is excludable. Some "merely incidental" personal use may qualify as excludable (de minimis fringe), but use of the vehicle to commute, according to the tax code, is to be included in income. There are many employers who do not follow this reporting requirement. That is between them and the IRS, though it is possible that the employee could be assessed tax should a dispute arise.

• **An employer-provided vehicle** used in an employer's business is not included in your income. However, if you also use that vehicle for commuting or other personal purposes, or use it in another trade or business, the value of such use is includable in your income. Please see USE OF A COMPANY CAR, above, for further comment.

• **Parking provided** by the employer may be excluded, whether the employers pays directly or pays a parking allowance to the employee.

(cont'd. page 24)

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(The Good News Is ... cont'd.)

**GENERAL EXCLUSIONS**

**Life Insurance Proceeds** — most are fully excludable.

**Death benefits paid** — by or for employer — excludable up to \$5000.

**Gifts & Inheritance** — property received is excludable, but there may be gift or estate tax consequences to the donor or decedent.

**Interest on state/local bonds** — still generally excludable, with exceptions.

**Compensation for injuries or sickness** — most workers compensation and law suits awards are excludable.

**Disability Benefits** — some, but not all, are excludable.

**Scholarships & fellowship grants** — some exclusion is still available, but rules were changed drastically by the Tax Reform Act of 1986.

**Gain on sale of residence** — exclusions available related to replacement of home and sale of home by taxpayer(s) age 55 and over.

**IMPORTANT NEW EXCLUSION!**

Starting for tax years beginning in 1990, some taxpayers will be able to exclude the interest on U.S. savings bonds if they use the bond proceeds for higher education for themselves, a spouse, or a dependent. The exclusion is phased out for higher-income taxpayers. For married filing jointly, the phase-out is from \$60,000 to \$90,000 of "modified adjusted gross income". The bonds involved must be qualified U.S. savings bonds issued (1) after 12/31/89, (2) to an individual who has reached age 24 before the bond is issued and (3) as Series EE bonds.

**Important:** The exclusion won't be available to an individual other than the owner of the bonds.

Bonds purchased by a parent and put in a child's name won't qualify, nor will bonds purchased by a grandparent or other relative, even if the bonds are put in the parent's name. If others want to help, the best way is to give the money to the parents and let the parents buy the bonds. For further details, call 1-800-USBONDS.

**THE BAD NEWS IS ...**

There have been some serious threats to these exclusions, most notably, Section 89. Section 89 was powerful and horrible in that the employee was to be the biggest victim and employer failure to comply. The basic point of the law change was non-discrimination in employee benefits. The problem was a comprehensive set of procedural and non-discrimination rules to apply for certain benefit plans for tax years beginning after 12/31/89. Plans included medical coverage, dependent care assistance, and fringe benefits, among others. If the procedural requirements were not met by the employer, all benefits provided by the plan would have been taxable to the employee. Those benefits were to include the employer cost (such as premiums paid) and the benefits payable under the plan (such as medical insurance reimbursements).

**A HAPPY ENDING?**

Enough PUBLIC OUTCRY, and heavy lobbying by the professional organizations, including the American Institute of Certified Public Accountants, worked to toss a bad law. Section 89 was repealed this fall, as part of the Omnibus Reconciliation Act of 1989. Also, as part of OBRA, the exclusions for legal services and educational assistance were extended.

For more information, you may order IRS Publication 525 (Taxable & Nontaxable Income) at 1-800-424-FORM.

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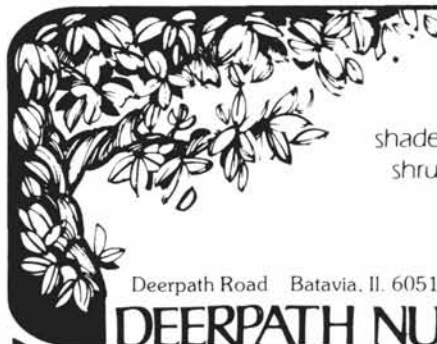


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# Proper Planning for Containment

by Brian R. Flood & Geoffrey Smith  
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Plan, practice, prepare a pesticide program promptly and practically for the containment provisions of the Illinois Lawn Care Products Application and Notice Act, alias The Act.

Briefly, The Act requires that after January 1, 1992, washing of pesticide application equipment must occur over an impervious material designed to capture spills. The washwater is to be captured and reused. Illinois has other rules regarding pesticide spill reporting for unrecovered spills.

You may have feelings toward the Act regarding the completeness, the format, the goal, the administration and the focus. However, we are in the 1990's and we do need to take a proactive common sense approach to resolving and preventing problems.

Take the opportunity to focus on the public's perspective of your pesticide usage. Perception is reality. Does your pesticide program run in a professional manner? If not, you could be jeopardizing our future. Agriculture data has shown that over 85% of loading areas to be contaminated and a majority of on-site wells associated with the load area were also contaminated.

Here are a few suggestions that may give you some ideas as to how to systematically and incrementally improve your operation without destroying your annual budget.

**PROTECT THE WATER SUPPLY:** Do not mix or load near the well. Utilize a 'break tank' with a 6-inch fixed air gap between the top of the break tank and the outlet end of the fill hose. Pump the water from the break tank to your sprayer. Do not rely on costly and ineffective back flow prevention valves. The break tank makes efficient economical environmental sense.

**PROTECT YOUR WORKERS:** Have copies of MSDS sheets and labels available. Keep your workers informed and stress cleanliness and safety.

**CONTAINMENT AREA DESIGN:** Mix and load in a well-ventilated clean area. If the load area and wash area are to be outdoors, provisions for rain water by pass and/or collection and storage will need to be made. A 12' x 14' pad will collect over 100 gallons of water for every inch of rain. Illinois averages 30-40 inches of precipitation per year. A large concrete load pad is one big rain gauge. If you keep the pad clean the rainwater can be discharged. If you do not keep the pad clean you will be generating a lot of rinsate water. The rinsate will require storage and that storage will require more containment. Keep the pad clean because it is a lot easier and cheaper.

Financial resources are limited, and we all must set priorities. The goal of the Act is to reduce point source pollution. However, Mother Nature would be better served by building wildlife habitat rather than constructing a large concrete rain gauge. People provide containment not concrete. Remember as the Department of Transportation has clearly demonstrated. There are two types of concrete in Illinois one that is cracked and one that is going to crack. The vast majority of lawn care application

(cont'd. page 30)

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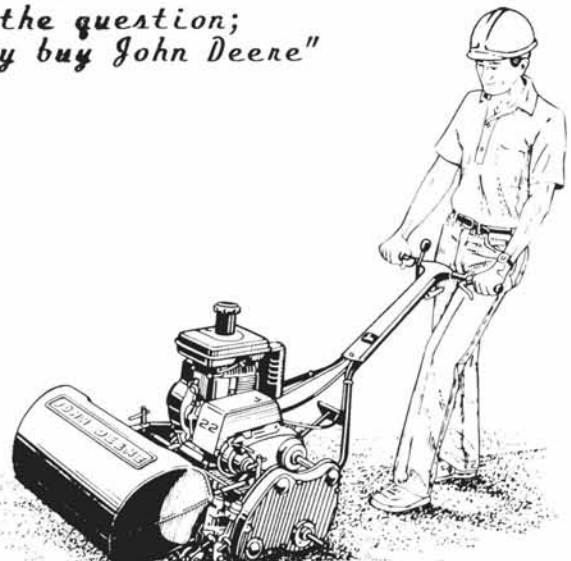


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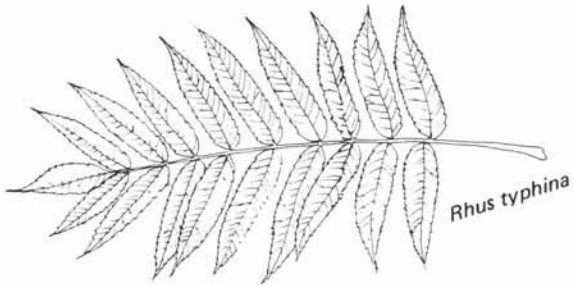
# Leaves, Limbs, Needles and Boughs

by Fred D. Opperman

This month's selection is one that we all look forward to in the fall for its spectacular colors of orange, yellows and scarlets.

*Rhus typhina* (roos ti-fi'na) — Staghorn Sumac

Leaves: Alternate, compound, pinnate, 13 to 27 leaflets, often 19, entire leaf 1 to 2 inches long, each leaflet lance-oblong 2 to 5 inches long and 1 to 2 inches wide. Glaucous beneath, pubescent when young; petiole about 2" long and hairy.



Buds: Hairy, leaf scars not elevated and somewhat "C" shaped.

Stem: Stout, rounded, densely velvety hairy, concealing the lenticels, almost club-like; pith large yellowish white, aromatic when broken.

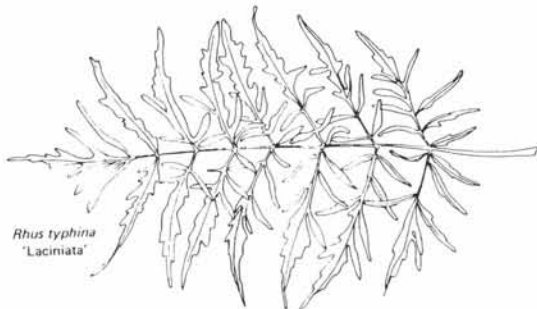


Size: 15 to 25' in a landscape situation, spread is usually equal to its height or greater.

Leaf Color: Bright green in summer and changing to the yellows, oranges and scarlets of fall.

Fruit: Crimson, late August through April, densely hairy drupe, closely packed in a pyramidal panicle.

Cultivars: "Dissecta" — Similar to "Laciniata", but leaflets more deeply divided; a fine textured ferny appearance.



Culture: Is easily transplanted, adapted to many soil types, but like so many of our plants, it prefers a well drained soil. Tolerates dry sterile soil, suckers profusely. This is a plant to be used in masses and naturalizing in out of the way areas.

Credit: "Manual of Woody Landscape Plants"

by Michael A. Dirr

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(Containment cont'd.)

equipment is light duty compared to agriculture equipment. You have special needs and uses, your pesticide management program should be designed for those needs and uses.

There are other options to concrete pads.

The Portable Containment System can provide immediate containment without construction. The units come in several sizes to fit your operation. The containment units are deployed when and where you need them and folded away when not required. This flexible option allows you to utilize existing buildings without construction or contamination. You lay the portable containment unit out and secure the unit in place. Washwater is sumped from the unit into your application equipment for immediate reuse and thus avoids rinsate storage needs. The concept is simple and that is why it works.

I would encourage you to look, to plan and to develop a system that meets your needs, your goals, and your financial resources.

### State Ranking of U. S. Golfers

Participation Rate <small>(Percentage of residents who play golf)</small>	Number of Participants <small>(To nearest thousand)</small>
1. Minnesota ..... 21.2	1. California ..... 2,842,000
2. Utah ..... 21.0	2. New York ..... 1,543,000
3T. North Dakota ..... 19.3	3. Illinois ..... 1,530,000
3T. Wisconsin ..... 19.3	4. Texas ..... 1,497,000
5T. Wyoming ..... 17.4	5. Ohio ..... 1,375,000
5T. Iowa ..... 17.4	6. Florida ..... 1,374,000
7. Idaho ..... 17.0	7. Michigan ..... 1,273,000
8. Michigan ..... 16.9	8. Pennsylvania ..... 1,071,000

9. Illinois ..... 16.0	9. Wisconsin ..... 769,000
10. Ohio ..... 15.3	10. New Jersey ..... 730,000
11. Nebraska ..... 15.0	11. Minnesota ..... 727,000
12. Colorado ..... 14.5	12. Massachusetts ..... 720,000
13. Massachusetts ..... 14.3	13. Indiana ..... 639,000
14T. Kansas ..... 13.8	14. North Carolina ..... 609,000
14T. Indiana ..... 13.8	15T. Georgia ..... 510,000
16. Arizona ..... 13.7	15T. Washington ..... 510,000
17T. New Mexico ..... 13.6	17. Missouri ..... 499,000
17T. Montana ..... 13.6	18. Virginia ..... 469,000
19. Washington ..... 13.4	19. Arizona ..... 416,000
20T. Nevada ..... 13.0	20. Colorado ..... 400,000
20T. South Dakota ..... 13.0	21. Iowa ..... 394,000
22. Oregon ..... 12.9	22. Maryland ..... 392,000
23. Connecticut ..... 12.8	23. Tennessee ..... 358,000
24. Florida ..... 12.3	24. Connecticut ..... 354,000
25. California ..... 11.8	25. Kentucky ..... 345,000
26. Missouri ..... 11.7	26. Oregon ..... 291,000
27. Vermont ..... 11.6	27. South Carolina ..... 290,000
28. Kentucky ..... 11.1	28. Kansas ..... 288,000
29T. North Carolina ..... 11.0	29. Utah ..... 267,000
29T. New Jersey ..... 11.0	30. Alabama ..... 264,000
31T. New York ..... 10.9	31. Oklahoma ..... 257,000
31T. Rhode Island ..... 10.9	32. Louisiana ..... 201,000
33T. Pennsylvania ..... 10.8	33. Nebraska ..... 194,000
33T. Maine ..... 10.8	34. New Mexico ..... 171,000
35. Texas ..... 10.5	35. West Virginia ..... 135,000
36T. Maryland ..... 10.0	36. Idaho ..... 130,000
36T. South Carolina ..... 10.0	37. Nevada ..... 118,000
38. Oklahoma ..... 9.5	38. Mississippi ..... 110,000
39T. Georgia ..... 9.5	39T. Arkansas ..... 109,000
39T. New Hampshire ..... 9.5	39T. Maine ..... 109,000
41. Virginia ..... 9.4	41. North Dakota ..... 99,000
42. Delaware ..... 9.3	42. Rhode Island ..... 93,000
43. West Virginia ..... 8.8	43. New Hampshire ..... 90,000
44. Tennessee ..... 8.5	44. Montana ..... 88,000
45. Alabama ..... 7.9	45. South Dakota ..... 77,000
46T. Louisiana ..... 5.6	46. Wyoming ..... 67,000
46T. Arkansas ..... 5.6	47. Vermont ..... 55,000
48. Mississippi ..... 5.3	48. Delaware ..... 52,000
49. District of Columbia ..... 4.0	49. District of Columbia ..... 23,000

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